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SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A. P.O. BOX 2938 MINNEAPOLIS, MN 55402-0938			PAREKH, NITIN	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 08/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/775,366	JIANG ET AL.	
	Examiner	Art Unit	
	Nitin Parekh	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 May 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52, 108-126, 136-154 and 252-278 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 272-274 is/are allowed.
- 6) ☒ Claim(s) 1-52, 108-126, 136-154, 252-270 and 277 is/are rejected.
- 7) ☒ Claim(s) 271, 275, 276 and 278 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 February 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>05-18-05</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 271, 275 and 276 are objected as follows:

- A. The claim limitations as recited in claims 275 and 276 include: "a Young's modulus of between .1 megapascals and about 20 megapascals, at a solder reflow temperature".

However, it is not clear from the claim language, at what reflow temperature the range/values of the Young's modulus are determined.

Claim Rejections - 35 USC § 102

2. Claims 1 and 11 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Yamamoto et al. (US Pat. 6265782) in view of Taguchi et al. (US Pat. 6429372).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 9, 11-13, 108, 118 and 120-122 are rejected under 35 U.S.C. 102(b) as being anticipated by Yamamoto et al. (US Pat. 6265782).

Regarding claims 1 and 11, Yamamoto et al. disclose an integrated circuit (IC) package comprising:

- a printed wiring board (PWB) substrate (4 in Fig. 4 and 5)
- a die (5 in Fig. 4 and 5)
- an adhesive material (3 and 1 in Fig. 4 and 5 respectively) having a Young's modulus (YM) of about 3 megapascals (Mpa) at a solder reflow temperature of 260 deg. C (Col. 3, line 34; Col. 7, lines 55-60) attaching the die to the substrate
- the adhesive material comprising a variety of resin/polymer based materials having different compositions/formulations (see examples in Tables 2 and 3; Col. 20-31) which include a component/copolymer and a mixture including a) epoxy, phenol, bisphenol, phenoxy, acrylate copolymer/polyacrylate, methyl acrylate (Col. 4, lines 25-60) having a wide range of molecular weight providing thermosetting properties, and b) polyimide, polyether-imide, etc. (Col. 5, line 55-Col. 6, line 10) providing thermoplastic properties, and
- such compositions/formulations providing a range properties/values to achieve the desired elasticity/modulus, strength, tackiness, surface hardness, and moisture resistance (Col. 20-31).

(Fig. 4 and 5; Col. 3-32).

Yamamoto et al. further disclose the effect/relationship of the YM v/s temperature being such that YM decreases with an increase of the temperature (see Col. 7, lines 50-53), thus the value of YM of 3.0 Mpa at about 260 deg. C for the adhesive corresponds to the YM of less than about 3.0 Mpa at a temperature above 260 deg. C or in a range of 260-280 deg. C.

Regarding claims 2, 108 and 120, Yamamoto et al. and Taguchi et al. teach the entire claimed structure as applied to claim 1 above, wherein Yamamoto et al. further teach a prior art package using conventional substrates such as ceramic to achieve low coefficient of thermal expansion (CTE) and to improve thermal performance (Col. 2, lines 1-13).

Regarding claims 9, 12, 13, 118, 121 and 122, Yamamoto et al. and Taguchi et al. teach the entire claimed structure as applied to claims 1 and 108 above, wherein Yamamoto et al. teach forming different compositions/formulations (see examples in Tables 2 and 3; Col. 20-31) including polymers and mixtures having a wide range of molecular weight, the mixture including acrylate copolymer/polyacrylate and polyimide (Col. 4, lines 25-60; Col. 5, lines 55-60).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 2, 9, 11, 12, 13, 108, 118 and 120-122 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) in view of Taguchi et al. (US Pat. 6429372).

Regarding claims 1 and 11, Yamamoto et al. disclose an integrated circuit (IC) package comprising:

- a printed wiring board (PWB) substrate (4 in Fig. 4 and 5)
- a die (5 in Fig. 4 and 5)
- an adhesive material (3 and 1 in Fig. 4 and 5 respectively) having a Young's modulus (YM) of about 3 megapascals (Mpa) at a solder reflow temperature (Col. 3, line 34; Col. 7, lines 55-60) attaching the die to the substrate
- the adhesive material comprising a variety of resin/polymer based materials having different compositions/formulations (see examples in Tables 2 and 3; Col. 20-31) which include a component/copolymer and a mixture including a) epoxy, phenol, bisphenol, phenoxy, acrylate copolymer/polyacrylate, methyl acrylate (Col. 4, lines 25-60) having a wide range of molecular weight providing thermosetting properties, and b) polyimide, polyether-imide, etc. (Col. 5, line 55-Col. 6, line 10) providing thermoplastic properties, and
- such compositions/formulations providing a range properties/values to achieve the desired elasticity/modulus, strength, tackiness, surface hardness, and moisture resistance (Col. 20-31).

(Fig. 4 and 5; Col. 3-32).

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Yamamoto et al. further disclose the effect/relationship of the YM v/s temperature being such that YM decreases with an increase of the temperature (see Col. 7, lines 50-53), thus the value of YM of 3.0 Mpa at about 260 deg. C for the adhesive corresponds to the YM of less than about 3.0 Mpa at a temperature above 260 deg. C or in a range of 260-280 deg. C.

Yamamoto et al. fail to explicitly teach the YM between about 0.1 and less than 3 Mpa.

Taguchi et al. teach an IC package having an adhesive, the adhesive comprising a variety of epoxy and silicone based resin/polymers having a range of YM including YM of about 1.0 Mpa (see Figure/Table 14) to achieve the desired joint strength and to reduce thermal stress (Col. 13, line 52- Col. 14, line 17). Furthermore, the determination of parameters and respective values/ranges such as YM, hardness, viscosity, thermal expansion coefficient (TEC), reflow temperature, etc. of various die attach material/encapsulant and respective composition/formulation in chip packaging/encapsulation technology art is a subject of routine experimentation and optimization to achieve the desired thermal, mechanical and electrical properties for the IC package.

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the adhesive having the YM between 0.1 and less than 3 Mpa at the solder reflow temperature between 200-280 deg. C. as taught by Taguchi et al. so that the joint strength and reliability can be improved and the thermal stress can be reduced in Yamamoto et al's package.

Regarding claims 2, 108 and 120, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claim 1 above, wherein Yamamoto et al. further teach a prior art package using conventional substrates such as ceramic to achieve low coefficient of thermal expansion (CTE) and to improve thermal performance (Col. 2, lines 1-13).

Regarding claims 9, 12, 13, 118, 121 and 122, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claims 1 and 108 above, wherein Yamamoto et al. teach forming different compositions/formulations (see examples in Tables 2 and 3; Col. 20-31) including polymers and mixtures having a wide range of molecular weight, the mixture including acrylate copolymer/polyacrylate and polyimide (Col. 4, lines 25-60; Col. 5, lines 55-60).

6. Claims 3-6 and 110-114 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) and Taguchi et al. (US Pat. 6429372) as applied to claims 1 and 108 respectively above, and further in view of Yew et al. (US Pat. 6049129) and Yamagata (US Pat. 5552637).

Regarding claims 3-6 and 110-114, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claims 1 and 108 respectively above, except the die comprising one or more of processor, memory, logic, communication or application specific circuits.

Yew et al. teach an adhesively bonded/encapsulated IC package having IC components including a memory/DRAM and logic circuits (Col. 3, line 40-50).

Yamagata teaches an adhesively bonded IC package/module in a variety of information processing/communication device operations/applications, the package/module having high frequency, high speed and high density/integration memory and central processing unit/processor circuits (Col. 1, lines 35-47; Col. Col. 8, lines 1-35).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die comprising one or more of memory, processor, logic or application specific//communication circuits as taught by Yew et al. and Yamagata so that the package density, speed and module integration can be improved in Taguchi et al. and Yamamoto et al's package.

7. Claims 7, 8, 10, 14, 15, 115-117, 119, 123 and 124 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) and Taguchi et al. (US Pat. 6429372) as applied to claims 1 and 108 respectively above, and further in view of Oxman et al. (US Pat. 6395124).

Regarding claims 7, 8, 10, 116, 117 and 119 Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claims 1 and 108 above, except the die attach material comprising epoxide, polyepoxide or polyolefin.

Oxman et al. teach an adhesively bonded IC package having epoxy resin compositions/formulations comprising epoxides including diepoxides, polyepoxides (Col. 11, line 43; Col. 11-13) monoolefins, diolefins and polyolefins (Col. 11, line 10; Col. 2, line 47) to achieve the desired physical properties in final cured composition

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material comprising epoxide or polyepoxide as taught by Oxman et al. so that the desired molecular weight and physical properties can be achieved in Taguchi et al. and Yamamoto et al's package.

Regarding claims 7, 8, 116 and 117, forming polyepoxide do not distinguish over Yamamoto et al., Taguchi et al. and Oxman, because only the final product/structure is relevant, not the process of making such as "forming polyepoxide from epoxide or copolymer or other chemical species". Note that a "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marrosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 706.03(e).

Regarding claims 14, 15, 115, 123 and 124, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claims 1 and 108 above, wherein Yamamoto et al. teach using compositions/formulations comprising the mixture including polyimide. Yamamoto et al. fail to teach the die attach material comprising a mixture or copolymer of one or more of epoxide, polyepoxide and polyimide.

Oxman et al. teach an adhesively bonded IC package having epoxy resin compositions/formulations comprising epoxides including diepoxides, polyepoxides (Col. 11, line 43; Col. 11-13) monoolefins, diolefins and polyolefins (Col. 11, line 10; Col. 2, line 47) to achieve the desired physical properties in a final cured composition

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material comprising a mixture or copolymer of polyepoxide and polyimide as taught by Oxman et al. so that the desired molecular weight and physical properties can be achieved in Yamamoto et al's package.

8. Claims 16 and 125 are rejected under 35 U.S.C. 103(a) as being unpatentable over the in view of Yamamoto et al. (US Pat. 6265782) and Taguchi et al. (US Pat. 6429372) as applied to claims 1 and 108 respectively above, and further in view of Penry (US Pat. 6049094).

Regarding claims 16 and 125, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claims 1 and 108 respectively above, except the die attach material having a Shore A hardness of greater than about 70.

Penry teaches using a conventional die attach material having Shore A hardness of about 80 (Col. 4, line 47).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material composition having a Shore A hardness of greater than about 70 as taught by Penry so that the desired molecular weight and physical properties can be achieved in Taguchi et al. and Yamamoto et al's package.

9. Claims 35, 36, 44, 46-48, 52, 136, 146, 148-150 and 154 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) in view of Narita (US Pat. 6144107).

Regarding claims 35, 44, 46-48, 52, 136, 146, 148-150 and 154, Yamamoto et al. disclose an integrated circuit (IC) package comprising:

- a printed wiring board (PWB) substrate (4 in Fig. 4 and 5)
- a die (5 in Fig. 4 and 5) , and
- an adhesive material (3 and 1 in Fig. 4 and 5 respectively) having a Young's modulus (YM) of about 3 megapascals (Mpa) at a solder reflow temperature of 260 deg. C (Col. 3, line 34; Col. 7, lines 55-60) attaching the die to the substrate

Yamamoto et al. further teach:

I. prior art packages having conventional rigid substrates such as ceramic to achieve low coefficient of thermal expansion (CTE) and to improve thermal performance (Col. 2, lines 1-13), and

II the adhesive material comprising a variety of resin/polymer based materials having different compositions/formulations (see examples in Tables 2 and 3; Col. 20-31) which include a component/copolymer and a mixture including:

- epoxy, phenol, bisphenol, phenoxy, acrylate copolymer/polyacrylate, methyl acrylate (Col. 4, lines 25-60) having a wide range of molecular weight providing thermosetting properties and polyimide, polyether-imide, etc. (Col. 5, line 55- Col. 6, line 10) providing thermoplastic properties, and
- such compositions/formulations providing a range properties/values to achieve the desired elasticity/modulus, strength, tackiness, surface hardness, and moisture resistance (Col. 20-31).

(Fig. 4 and 5; Col. 3-32).

Yamamoto et al. fail to teach the die attach material being rigid.

Narita teaches using an IC package having a variety of epoxy resin compositions/formulations including an epoxy resin having a hardening agent, the cured resin being rigid having a Shore D hardness around 85 to improve the moisture and crack resistance (Col. 6, line 64- Col. 7, line 5; Col. 5-7).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material being rigid as taught by Narita so that the moisture and crack resistance can be improved in Yamamoto et al's package.

Regarding claim 36, Yamamoto et al. and Narita teach substantially the entire claimed structure as applied to claim 35 above, wherein Yamamoto et al. further teach the substrate being a PWB.

10. Claims 17 and 126 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) and Taguchi et al. (US Pat. 6429372) as applied to claims 1 and 108 respectively above, and further in view of Narita (US Pat. 6144107).

Regarding claims 17 and 126, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claims 1 and 108 respectively above, except the die attach material having a Shore D hardness of greater than about 20.

Narita teaches using an IC package having an adhesive resin composition such that the adhesive material has a Shore D hardness between 20-30 to achieve the desired properties/flexibility after curing (Col. 6, line 38).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material composition having a Shore D hardness of greater than about 20 as taught by Narita so that the desired flexibility can be achieved in Taguchi et al. and Yamamoto et al.'s package.

11. Claims 18, 26, 28-30, 252, 260, 261, 263 and 277 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (US Pat. 6049129) in view of Yamamoto et al. (US Pat. 6265782), Taguchi et al. (US Pat. 6429372) and Satsu et al. (US Pat. 6225418).

Regarding claims 18, 26, 28-30, 252, 260, 261 and 263, Yew et al. disclose an integrated circuit (IC) package comprising:

- a printed wiring board (PWB) substrate (76 in Fig. 3, 4 and 6)
- a die/chip (50 in Fig. 3, 4 and 6)
- an adhesive/resin material (see 90 at the edges of the die and a mid portion between the die and the PWB respectively and 60 in Fig. 3, 4 and 6) attaching the die to the PWB substrate, and
- the die attach adhesive resin comprising a variety of material/thermosetting resin compositions including epoxies, polyimides and silicones (Col. 4, lines 30-55; Col. 7, line 30) having a range properties/values including CTE, elasticity/modulus, strength, etc. (see resin properties in Col. 4 and 7) where CTE ranges from 40-150 ppm/deg. C (see resin properties in Col. 7) to provide reduced failure due to thermal expansion mismatch, thermal shock, cracking and improve adhesion/encapsulation processing (Col. 10, lines 47-60; Col. 6, lines 30-35), the silicone resin having a low CTE of about 40 ppm/deg. C

(Fig. 3 and 6; Col. 3-10).

Yew et al. fail to teach the die attach material having the CTE ranges from about 1-62, 151-400 or 400 ppm/deg. C and/or the YM between 0.1 and less than 3 Mpa at solder reflow temperature between 200-280 deg. C.

Yamamoto et al. teach an integrated circuit (IC) package having an adhesive material (3 and 1 in Fig. 4 and 5 respectively) having a Young's modulus (YM) of about

3 megapascals (Mpa) at a solder reflow temperature of 260 deg. C (Col. 3, line 34; Col. 7, lines 55-60) attaching the die to the substrate wherein the substrate is further conventionally attached/bonded to a substrate/board to provide an electrical interconnection for the desired application using the solder reflow (see Col. 1, lines 25-40). The adhesive material further comprises:

- a variety of resin/polymer based materials having different compositions/formulations (see examples in Tables 2 and 3; Col. 20-31) which include a component/copolymer and a mixture including epoxy, phenol, bisphenol, phenoxy, acrylate copolymer/polyacrylate, methyl acrylate (Col. 4, lines 25-60) having a wide range of molecular weight providing thermosetting/rigid properties and polyimide, polyether-imide, etc. (Col. 5, line 55- Col. 6, line 10) providing thermoplastic properties, and
- such compositions/formulations providing a range properties/values to achieve the desired elasticity/modulus, strength, tackiness, surface hardness, and moisture resistance ((Fig. 4 and 5; Col. 20-31).

Yamamoto et al. further disclose the effect/relationship of the YM v/s temperature being such that YM decreases with an increase of the temperature (see Col. 7, lines 50-53), thus the value of YM of 3.0 Mpa for the adhesive at the temperature of 260 deg. C corresponds to the YM of less than 3.0 Mpa at a temperature above 260 deg. C or in a range of 260-280 deg. C.

Taguchi et al. teach an IC package having an adhesive, the adhesive comprising a variety of epoxy and silicone based resin/polymers having a range of YM including YM

of about 1.0 Mpa (see Figure/Table 14) to achieve the desired joint strength and to reduce thermal stress (Col. 13, line 52- Col. 14, line 17).

Satsu et al. teach using a variety of die attach/underfill thermosetting resin compositions to achieve the desired heat resistance, crack resistance, modulus and thermal properties (4 in Fig. 2; 8 in Fig. 4A/B; Col. 3-24) in an IC package where the resin compositions/formulations have a range of properties/values including elastic modulus, CTE, adhesive strength, etc. where the CTE has a different range of values, the range being 63-250 ppm/deg. C (see CTE listed in Tables 1-3).

Furthermore, the determination of parameters and respective values/ranges such as YM, hardness, viscosity, thermal expansion coefficient (TEC), reflow temperature, etc. of various die attach material/encapsulant and respective composition/formulation in chip packaging/encapsulation technology art is a subject of routine experimentation and optimization to achieve the desired thermal, mechanical and electrical properties for the IC package.

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material composition having a CTE being less than 400 ppm/deg. C or that between 1-62 ppm/deg. C or 151-400 ppm/deg. C and YM between 0.1 and less than 3 Mpa at solder reflow temperature between 200-280 deg. C. as taught by Satsu et al., Taguchi et al. and Yamamoto et al. so that the defects due to cracking, voids and thermal mismatch can be reduced and the adhesion can be improved in Yew et al's package.

Regarding claim 277, Yew et al., Yamamoto et al., Taguchi et al. and Satsu et al. teach substantially the entire claimed structure as applied to claim 18 above, wherein Yew et al. (see Fig. 4) further teach:

- the chip/die having a second/bottom surface, the bottom surface including a first area with pads/contacts (see 120 in Fig. 4) thereon and a second area free of contacts and radially outside the first area
- the PWB substrate having a first/top surface that is mechanically attached to the second area of the second/bottom surface of the die with the die attach material, the substrate including an interior aperture aligned with the first area of the bottom surface of the die, the substrate further including a second/bottom surface that includes pads/contacts (see 100 in Fig. 4) thereon
- a plurality of bonding wires (see 80 in Fig. 4) connected to the contacts on the bottom surface of the die, extending through the interior aperture of the substrate, and connected to the contacts on the bottom surface of the substrate, and
- a potting material/molding compound (90 in Fig. 4; Col. 7, lines 25-65) covering the die, the die attach material, and a portion of the top surface of the substrate, the potting material/molding compound extending through the interior aperture of the substrate and enclosing the wires, the solder balls configuration being such that a mounting substrate/board can be attached without any contact to the potting material/molding compound (see 150 and 90 in Fig. 4)

(Fig. 4, Col. 8, line 45- Col. 9, line 15; Col. 3-11).

13. Claim 109 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) and Taguchi et al. (US Pat. 6429372) as applied to claim 108 and further in view of Kunitomo et al. (US Pat. 5550408).

Regarding claim 109, Yamamoto et al. and Taguchi et al. teach substantially the entire claimed structure as applied to claim 108 above, except the substrate comprising a multi-metal layer ceramic.

Kunitomo et al. teach an IC package having a laminated/multi-metal layered ceramic substrate (MLC 11 in Fig. 3; Col. 2, lines 15-25; Col. 9, line 5-45).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the multi-metal layer ceramic as taught by Kunitomo et al. so that multilevel routing and electrical performance can be improved in Taguchi et al. and Yamamoto et al's package.

14. Claims 19 and 253 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (US Pat. 6049129), Yamamoto et al. (US Pat. 6265782), Taguchi et al. (US Pat. 6429372) and Satsu et al. (US Pat. 6225418) as applied to claims 18 and 252 above, and further in view of APA.

Regarding claims 19 and 253, Yew et al. Yamamoto et al., Taguchi et al. and Satsu et al. teach substantially the entire claimed structure as applied to claims 18 and 252 respectively above, except the substrate comprising a single metal layer glass-epoxide.

Yamamoto et al. further teach using conventional single or double wiring/metal layer glass-epoxy/polyimide and ceramic substrates (Col. 1, line 25- Col. 2, line 5).

APA teaches using conventional substrates and board made from a glass-epoxide and ceramic (specification pages 1, lines 15-28).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the substrate comprising a single metal layer glass-epoxide as taught by Yamamoto et al. and APA so that the rigidity and the thermal mismatch can be reduced in Yew et al., Taguchi et al. and Satsu et al's package.

15. Claims 20-23 and 254-257 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (US Pat. 6049129), Yamamoto et al. (US Pat. 6265782), Taguchi et al. (US Pat. 6429372) and Satsu et al. (US Pat. 6225418) as applied to claims 18 and 252 above, and further in view of Yamagata (US Pat. 5552637).

Regarding claims 20-23 and 254-257, Yamamoto et al., Taguchi et al., Yew et al. and Satsu et al. teach substantially the entire claimed structure as applied to claims 18 and 252 above, except the die comprising one or more of memory, processor, logic or application specific circuits respectively.

Yew et al. further teach an adhesively bonded/encapsulated IC package having IC components including a memory/DRAM and logic circuits (Col. 3, line 40-50).

Yamagata teaches an adhesively bonded IC package/module in a variety of information processing device operations/applications, the package/module having high speed and high density/integration memory and central processing unit/processor circuits (Col. 1, lines 35-47; Col. 8, lines 1-35).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die comprising one or more of memory,

processor, logic or application specific circuits as taught by Yew et al. and Yamagata so that the package density, speed and module integration can be improved in Satsu et al., Taguchi et al. and Yamamoto et al's package.

16. Claims 24, 25, 27, 31, 32, 258, 259 and 262 and 264-267 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (US Pat. 6049129), Yamamoto et al. (US Pat. 6265782), Taguchi et al. (US Pat. 6429372) and Satsu et al. (US Pat. 6225418) as applied to claims 18, 252 and 261 above, and further in view of Oxman et al. (US Pat. 6395124).

Regarding claims 24, 25, 27, 258, 259 and 262, Yew et al., Taguchi et al., Yamamoto et al., and Satsu et al. teach substantially the entire claimed structure as applied to claims 18, 252 and 261 above, except the die attach material comprising polyepoxide or polyolefin.

Oxman et al. teach an adhesively bonded IC package having epoxy resin compositions/formulations comprising epoxides including diepoxides, polyepoxides (Col. 11, line 43; Col. 11-13) monoolefins, diolefins and polyolefins (Col. 11, line 10; Col. 2, line 47) to achieve the desired physical properties in final cured composition

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material comprising epoxide or polyepoxide as taught by Oxman et al. so that the desired molecular weight and physical properties can be achieved in Yew et al. and Satsu et al., Taguchi et al. and Yamamoto et al's package.

Regarding claims 24, 25, 258 and 259, forming polyepoxide do not distinguish over Yew et al., Yamamoto et al., Taguchi et al. and Satsu et al. and Oxman, because only the final product/structure is relevant, not the process of making such as “forming polyepoxide from epoxide or copolymer or other chemical species”. Note that a “product by process” claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marrosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 706.03(e).

Regarding claims 31, 32 and 264-267, Yew et al., Yamamoto et al., Taguchi et al. and Satsu et al. teach substantially the entire claimed structure as applied to claims 18 and 261 above, wherein Yamamoto et al. teach using compositions/formulations comprising the mixture including polyimide, except the die attach material comprising a mixture or copolymer of polyepoxide and polyimide.

Oxman et al. teach an adhesively bonded IC package having epoxy resin compositions/formulations comprising epoxides including diepoxides, polyepoxides

(Col. 11, line 43; Col. 11-13) monoolefins, diolefins and polyolefins (Col. 11, line 10; Col. 2, line 47) to achieve the desired physical properties in final cured composition

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material comprising a mixture or copolymer of polyepoxide and polyimide as taught by Oxman et al. so that the desired molecular weight and physical properties can be achieved in Yew et al., Taguchi et al. and Satsu et al. and Yamamoto et al's package.

17. Claims 33 and 268 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (US Pat. 6049129), Yamamoto et al. (US Pat. 6265782), Taguchi et al. (US Pat. 6429372) and Satsu et al. (US Pat. 6225418) as applied to claims 18 and 261 respectively above, and further in view Penry (US Pat. 6049094).

Regarding claims 33 and 268, Yew et al., Yamamoto et al., Taguchi et al. and Satsu et al. teach substantially the entire claimed structure as applied to claims 18 and 261 above, except the die attach material having a Shore A hardness of greater than about 70.

Penry teaches using a conventional die attach material having Shore A hardness of about 80 (Col. 4, line 47).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material composition having a Shore A hardness of greater than about 70 as taught by Penry so that the desired molecular weight and physical properties can be achieved in Yew et al., Satsu et al., Taguchi et al. and Yamamoto et al's package.

18. Claims 34 and 269 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (US Pat. 6049129), Yamamoto et al. (US Pat. 6265782), Taguchi et al. (US Pat. 6429372) and Satsu et al. (US Pat. 6225418) as applied to claims 18 and 261 respectively above, and further in view of Narita (US Pat. 6144107).

Regarding claims 34 and 269, Yew et al., Yamamoto et al., Taguchi et al. and Satsu et al. teach substantially the entire claimed structure as applied to claims 18 and 261 above, except the die attach material having a Shore D hardness of greater than about 20.

Narita teaches using an IC package having an adhesive resin composition such that the adhesive material has a Shore D hardness between 20-30 to achieve the desired properties/flexibility after curing (Col. 6, line 38).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material composition having a Shore D hardness of greater than about 20 as taught by Narita so that the desired flexibility can be achieved in Yew et al., Satsu et al., Taguchi et al. and Yamamoto et al's package.

19. Claims 37-41 and 139-142 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782) and Narita (US Pat. 6144107) as applied to claims 35 and 136 respectively above, and further in view of Yew et al. (US Pat. 6049129) and Yamagata (US Pat. 5552637).

Regarding claims 37-41 and 139-142, Yamamoto et al., and Narita teach substantially the entire claimed structure as applied to claim 35 above, except the die comprising one or more of communication, memory, processor, logic or application specific circuits respectively.

Yew et al. further teach an adhesively bonded/encapsulated IC package having IC components including a memory/DRAM and logic circuits (Col. 3, line 40-50).

Yamagata teaches an adhesively bonded IC package/module in a variety of information processing/communication device operations/applications, the package/module having high frequency, high speed and high density/integration memory and central processing unit/processor circuits (Col. 1, lines 35-47; Col. 8, lines 1-35).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die comprising one or more of communication, memory, processor, logic or application specific circuits as taught by Yew et al. and Yamagata so that the package density, speed and module integration can be improved in Narita, and Yamamoto et al's package.

20. Claims 42, 43, 45, 49, 50, 143, 144, 145, 147, 151 and 152 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782), and Narita (US Pat. 6144107) as applied to claims 35 and 136 above, and further in view of Oxman et al. (US Pat. 6395124).

Regarding claims 42, 43, 45, 144, 145 and 147, Yamamoto et al., and Narita teach substantially the entire claimed structure as applied to claim 35 above, except the die attach material comprising polyepoxide or polyolefin.

Oxman et al. teach an adhesively bonded IC package having epoxy resin compositions/formulations comprising epoxides including diepoxides, polyepoxides (Col. 11, line 43; Col. 11-13) monoolefins, diolefins and polyolefins (Col. 11, line 10; Col. 2, line 47) to achieve the desired physical properties in final cured composition

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material comprising epoxide or polyepoxide as taught by Oxman et al. so that the desired molecular weight and physical properties can be achieved in Narita, and Yamamoto et al's package.

Regarding claims 42 and 43, forming polyepoxide do not distinguish over Yamamoto et al., and Narita, because only the final product/structure is relevant, not the process of making such as "forming polyepoxide from epoxide or copolymer or other chemical species". Note that a "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marrosi et al., 218 USPQ 289, all of which make it

clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 706.03(e).

Regarding claims 49, 50, 143, 151 and 152, Yamamoto et al., and Narita teach substantially the entire claimed structure as applied to claims 35 and 136 above, wherein Yamamoto et al. teach using compositions/formulations comprising the mixture including polyimide, except the die attach material comprising a mixture or copolymer of polyepoxide and polyimide.

Oxman et al. teach an adhesively bonded IC package having epoxy resin compositions/formulations comprising epoxides including diepoxides, polyepoxides (Col. 11, line 43; Col. 11-13) monoolefins, diolefins and polyolefins (Col. 11, line 10; Col. 2, line 47) to achieve the desired physical properties in final cured composition

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material comprising a mixture or copolymer of polyepoxide and polyimide as taught by Oxman et al. so that the desired molecular weight and physical properties can be achieved in Narita, and Yamamoto et al's package.

21. Claims 51 and 153 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782), and Narita (US Pat. 6144107) as applied to claims 35 and 136 respectively above, and further in view of Penry (US Pat. 6049094).

Regarding claims 51 and 153, Yamamoto et al., and Narita teach substantially the entire claimed structure as applied to claim 35 above, except the die attach material having a Shore A hardness of greater than about 70.

Penry teaches using a conventional die attach material having Shore A hardness of about 80 (Col. 4, line 47).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die attach material composition having a Shore A hardness of greater than about 70 as taught by Penry so that the desired molecular weight and physical properties can be achieved in Narita, and Yamamoto et al's package.

22. Claims 137 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782), and Narita (US Pat. 6144107) as applied to claim 136 above, and further in view of Kunitomo et al. (US Pat. 5550408).

Regarding claim 137, Yamamoto et al., and Narita teach substantially the entire claimed structure as applied to claim 136 above, except the substrate comprising a multi-metal layer ceramic.

Kunitomo et al. teach an IC package having a laminated/multi-metal layered ceramic (MLC 11 in Fig. 3; Col. 2, lines 15-25; Col. 9, line 5-45).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the multi-metal layer ceramic as taught by Kunitomo et al. so that multilevel routing and electrical performance can be improved in Narita and Yamamoto et al's package.

23. Claim 138 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (US Pat. 6265782), and Narita (US Pat. 6144107) as applied to claim 136 above, and further in view of APA.

Regarding claim 138, Yamamoto et al., and Narita teach substantially the entire claimed structure as applied to claim 136 above, except the die comprising a germanium.

APA teaches the die comprising a germanium material (specification page 1, line 18).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die comprising the germanium as taught by APA so that the package density, speed and module integration can be improved in Narita, and Yamamoto et al's package.

Allowable Subject Matter

24. Claims 271, 275 and 276 would be allowable if rewritten or amended to overcome the objections set forth in this Office action.

25. Claim 278 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

26. Claims 272-274 are allowed.

Response to Arguments

27. Applicant's arguments filed on 05-18-05 have been fully considered but they are not persuasive.

A. Applicant's arguments regarding the YM value in the range of 260-280 deg. C in the primary reference of Yamamoto et al. have been addressed in the above rejections.

B. Applicant contends that Narita does not teach the die attach material being rigid.

However, the covering/encapsulating material used in Narita is composed of conventional epoxy based resin/polymer formulation having rigid properties. Therefore, Narita's teaching related to using the conventional epoxy material having rigid properties is applied to Yamamoto et al's epoxy based die attach formulations.

Conclusion

28. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 571-272-1663. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's acting supervisor, Steven Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2811

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAN or Public PAG. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAG system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



NP

NITIN PAREKH

07-25-05

PRIMARY EXAMINER

TECHNOLOGY CENTER 2800